## APPENDIX A

### COMMENTS

1. Alexander Graham Bell Association for the Deaf and Hard of Hearing (AG Bell)
2. Association of Late Deafened Adults, Inc. (ALDA)
3. Consumer Electronics Manufacturers Association (CEA)
4. General Instrument Corporation (GI)
5. Home Box Office (HBO)
6. Massachusetts Assistance Technology Partnership (MATP)
7. Media Captioning Services (MCS)
8. National Association of Broadcasters (NAB)
9. National Association of the Deaf & The Consumer Action Network (NADCAN)
10. National Cable Television Association (NCTA)
11. Self Help for Hard of Hearing People, Inc. (SHHH)
12. Telecommunications for the Deaf, Inc. (TDI)
13. Thomson Consumer Electronics, Inc. (Thomson)
14. Toshiba America Consumer Production (Toshiba)
15. VITAC Corporation (Vitac)
16. WGBH Educational Foundation (WGBH)

### REPLY COMMENTS

1. American Society for Deaf Children (ASDC)
2. AT&T
3. Khari Balogun
4. Frank Bechter
5. Lawrence Brick
6. Stephanie Buell
7. Joan Cassidy
8. Cynthia Clark
9. Consumer Electronics Association (CEA)
10. Council of Organizational Representatives (COR)
11. Nancy Creighton
12. Patricia Dobosh
13. Charles Estes
14. Michael Gallagher
15. General Instruments (GI)
16. Home Box Office (HBO)
17. Pamela Holmes (Consumer Advocate)
18. Roger Kraft
19. Larry Littleton
20. Ruben Martinez
21. Mentkowski Family
22. National Association of Broadcasters (NAB)
23. National Catholic Office for the Deaf (NCOD)
24. Northern Virginia Resource Center for Deaf and Hard Of Hearing (NVRC)
25. Northern Virginia United for Deaf and Hard of Hearing Children (NVU)

26. Pennsylvania Parents of Deaf and Hard of Hearing Children (PPDHHC)
27. Sarnoff Corporation (Sarnoff)
28. Kay Seib
29. Self Help for Hard of Hearing People (SHHH)
30. Telecommunications for the Deaf, Inc. (TDI)
31. Texas Commission for the Deaf & Hard of Hearing (TCDHH)
32. Thomson Consumer Electronics, Inc. (TCE)
33. VITAC Corporation (Vitac)
34. WGBH Educational Foundation (WGBH)

## APPENDIX B - RULES

PART 15 – RADIO FREQUENCY DEVICES

The authority for Part 15 is amended to read as follows:

AUTHORITY: 47 U.S.C. 154, 302, 303, 304, 307, 330, and 544A.

Title 47 of the Code of Federal Regulations, Part 15 is amended as follows:

1. The heading of Section 15.119 is revised to read as follows:

Section 15.119 Closed caption decoder requirements for analog television receivers.

2. A new Section 15.122 is added to read as follows:

Section 15.122 Closed caption decoder requirements for digital television receivers and converter boxes.

(a) (1) Effective July 1, 2002, all digital television receivers with picture screens in the 4:3 aspect ratio with picture screens measuring 13 inches or larger diagonally, all digital television receivers with picture screens in the 16:9 aspect ratio measuring 7.8 inches or larger vertically and all separately sold DTV tuners shipped in interstate commerce or manufactured in the United States shall comply with the provisions of this section.

Note: This paragraph places no restrictions on the shipping or sale of digital television receivers that were manufactured before July 1, 2002.

(2) Effective July 1, 2002, DTV converter boxes that allow digitally transmitted television signals to be displayed on analog receivers shall pass available analog caption information to the attached receiver in a form recognizable by that receiver's built-in caption decoder circuitry.

Note: This paragraph places no restrictions on the shipping or sale of DTV converter boxes that were manufactured before July 1, 2002.

(b) Digital television receivers and tuners must be capable of decoding closed captioning information that is delivered pursuant to the industry standard EIA-708-B, "Digital Television (DTV) Closed Captioning," Electronics Industries Association (1999). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Digital television manufacturers may wish to view EIA-708-B in its entirety. Copies of EIA-708-B may be obtained from: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, http://www.global.ihs.com/. Copies of EIA-708-B may be inspected during regular business hours at the following locations: Federal Communications Commission, 445 12th Street, S.W., Washington, D.C. 20554, or the Office of the Federal Register, 800 N. Capitol Street, N.W., Washington, D.C.

(c) *Services.* (1) Decoders must be capable of decoding and processing data for the six standard services, Caption Service #1 through Caption Service #6.

(2) Decoders that rely on Program and System Information Protocol data to implement closed captioning functions must be capable of decoding and processing the Caption Service Directory data. Such decoders must be capable of decoding all Caption Channel Block Headers consisting of Standard Service Headers, Extended Service Block Headers, and Null Block headers. However, decoding of the

data is required only for Standard Service Blocks (Service IDs <= 6), and then only if the characters for the corresponding language are supported. The decoders must be able to display the directory for services 1 through 6.

(d) *Code Space Organization.* (1) Decoders must support Code Space C0, G0, C1, and G1 in their entirety.

| | C 0 | | G 0 | | | | | | C 1 | | G 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B7-b4 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| b3-b0 0 | NUL | EXT1 | SP | 0 | @ | P | ` | p | CW0 | SPA | NBS | ° | À | Đ | à | ð |
| 1 | | | ! | 1 | A | Q | a | q | CW1 | SPC | ¡ | ± | Á | Ñ | á | ñ |
| 2 | | | " | 2 | B | R | b | r | CW2 | SPL | ¢ | ² | Â | Ò | â | ò |
| 3 | ETX | | # | 3 | C | S | c | s | CW3 | | £ | ³ | Ã | Ó | ã | ó |
| 4 | | | $ | 4 | D | T | d | t | CW4 | | ¤ | ´ | Ä | Ô | ä | ô |
| 5 | | | % | 5 | E | U | e | u | CW5 | | ¥ | µ | Å | Õ | å | õ |
| 6 | | | & | 6 | F | V | f | v | CW6 | | ¦ | ¶ | Æ | Ö | æ | ö |
| 7 | | | ' | 7 | G | W | g | w | CW7 | SWA | § | · | Ç | × | ç | ÷ |
| 8 | BS | P16 | ( | 8 | H | X | h | x | CLW | DF0 | ¨ | ¸ | È | Ø | è | ø |
| 9 | | | ) | 9 | I | Y | i | y | DSW | DF1 | © | ¹ | É | Ù | é | ù |
| A | | | * | : | J | Z | j | z | HDW | DF2 | ª | º | Ê | Ú | ê | ú |
| B | | | + | : | K | [ | k | { | TGW | DF3 | « | » | Ë | Û | ë | û |
| C | FF | | , | < | L | \ | l | \| | DLW | DF4 | ¬ | ¼ | Ì | Ü | ì | ü |
| D | CR | | - | = | M | ] | m | } | DLY | DF5 | - | ½ | Í | Ý | í | ý |
| E | HCR | | . | > | N | ^ | n | ~ | DLC | DF6 | ® | ¾ | Î | Þ | î | þ |
| F | | | / | ? | O | _ | o | ♪ | RST | DF7 | ¯ | ¿ | Ï | ß | ï | ÿ |

| | C 2 | | G 2 | | | | | | C 3 | | G 3 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | TSP | | | | | | | | CC | | | | | |
| 1 | | | NBTSP | ‘ | | | | | | | | | | | | |
| 2 | | | | ’ | | | | | | | | | | | | |
| 3 | | | | “ | | | | | | | | | | | | |
| 4 | | | | ” | | | | | | | | | | | | |
| 5 | | | … | | | | | | | | | | | | | |
| 6 | | | | | | | | 1/8 | | | | | | | | |
| 7 | | | | | | | | 3/8 | | | | | | | | |
| 8 | | | | | | | | 5/8 | | | | | | | | |
| 9 | | | | ™ | | | | 7/8 | | | | | | | | |
| A | | | Š | š | | | | \| | | | | | | | |
| B | | | | | | | | \| | | | | | | | |
| C | | | Œ | œ | | | | ⌊ | | | | | | | | |
| D | | | | SM | | | | — | | | | | | | | |
| E | | | | | | | | ⌋ | | | | | | | | |
| F | | | | Ÿ | | | | \| | | | | | | | |

Table 1 DTVCC Code Set Mapping

(2) The following characters within code space G2 must be supported:

- transparent space (TSP)
- non-breaking transparent space (NBTSP)
- solid block (■)
- trademark symbol (™)
- Latin-1 characters (Š, Œ, š, œ, Ÿ)

(3) The substitutions in Table 2 are to be made if a decoder does not support the remaining G2 characters.

| G2 Character | Substitute With |
|---|---|
| Open single quote (‘), G2 char code 0x31 | G0 single quote (’), char code 0x27 |
| Close single quote(’), G2 char code 0x32 | G0 single quote (’), char code 0x27 |
| Open double quote (“), G2 char code 0x33 | G0 double quote (”), char code 0x22 |
| Close double quote (”), G2 char code 0x34 | G0 double quote (”), char code 0x22 |
| Bold bullet (•), G2 char code 0x35 | G1 bullet (·), char code 0xB7 |
| Ellipsis(…), G2 char code 0x25 | G0 underscore (_), char code 0x5F |
| One-eighth (1/8), G2 char code 0x76 | G0 percent sign (%), char code 0x25 |
| Three-eighths (3/8), G2 char code 0x77 | G0 percent sign (%), char code 0x25 |
| Five-eighths (5/8), G2 char code 0x78 | G0 percent sign (%), char code 0x25 |
| Seven-eighths (7/8), G2 char code 0x79 | G0 percent sign (%), char code 0x25 |
| Vertical border (│), G2 char code 0x7A | G0 stroke (\|), char code 0x7C |
| Upper-right border (┐), G2 char code 0x7B | G0 dash (-), char code 0x2D |
| Lower-left border (└), G2 char code 0x7C | G0 dash (-), char code 0x2D |
| Horizontal border (—), G2 char code 0x7D | G0 dash (-), char code 0x2D |
| Lower-right border (┘), G2 char code 0x7E | G0 dash (-), char code 0x2D |
| Upper-left border (┌), G2 char code 0x7F | G0 dash (-), char code 0x2D |

Table 2 G2 Character Substitution Table

(4) Support for code spaces C2, C3, and G3 is optional. All unsupported graphic symbols in the G3 code space are to be substituted with the G0 underscore character (_), char code 0x5F.

(e) *Screen Coordinates.* Table 1 specifies the screen coordinate resolutions and limits for anchor point positioning in 4:3 and 16:9 display formats, and the number of characters per row.

| Screen Aspect Ratio | Maximum Anchor Position Resolution | Minimum Anchor Position Resolution | Maximum Displayed Rows | Maximum Characters per Row |
|---|---|---|---|---|
| 4:3 | 75v x 160h | 15v x 32h | 4 | 32 |
| 16:9 | 75v x 210h | 15v x 42h | 4 | 42 |
| other | 75v x (5 x H) | 15v x H* | 4 | * |

Table 1 Screen Coordinate Resolutions & Limits

*H = 32 x (the width of the screen in relation to a 4:3 display). For example, the 16:9 format is 1/3 wider than a 4:3 display; thus, H = 32 * 4/3 = 42.667, or 42.

This means that the minimum grid resolution for a 4:3 aspect ratio instrument is 15 vertical positions x 32 horizontal positions. This minimum grid resolution for 16:9 ratio instrument is 15 vertical positions x 42 horizontal positions. These minimum grid sizes are to cover the entire safe-title area of the corresponding screen.

The minimum coordinates equate to a 1/5 reduction in the maximum horizontal and vertical grid resolution coordinates. Caption providers are to use the maximum coordinate system values when specifying anchor point positions. Decoders using the minimum resolution are to divide the provided horizontal and vertical screen coordinates by 5 to derive the equivalent minimum coordinates.

Any caption targeted for both 4:3 and 16:9 instruments is limited to 32 contiguous characters per row. If a caption is received by a 4:3 instrument that is targeted for a 16:9 display only, or requires a window width greater than 32 characters, then the caption may be completely disregarded by the decoder. 16:9 instruments should be able to process and display captions intended for 4:3 displays, providing all other minimum recommendations are met.

If the resulting size of any window is larger than the safe title area for the corresponding display's aspect ratio, then this window will be completely disregarded.

(f) *Caption Windows.* (1) Decoders need to display no more than 4 rows of captions on the screen at any given time, regardless of the number of windows displayed. This implies that no more than 4 windows can be displayed at any given time (with each having only one caption row). However, decoders should maintain storage to support a minimum total of 8 rows of captions. This storage is needed for the worst-case support of a displayed window with 4 rows of captioning and a non-displayed window which is buffering the incoming rows for the next 4-row caption. As implied above, the maximum number of windows that may be displayed at any one time by a minimum decoder implementation is 4. If more than 4 windows are defined in the caption stream, the decoder may disregard the youngest and lowest priority window definition(s). Caption providers must be aware of this limitation, and either restrict the total number of windows used or accept that some windows will not be displayed.

(2) Decoders do not need to support overlapped windows. If a window overlaps another window, the overlapped window need not be displayed by the decoder.

(3) At a minimum, decoders will assume that all windows have rows and columns "locked". This implies that if a decoder implements the SMALL pen-size, then word-"un"wrapping, when shrinking captions, need not be implemented. Also, if a decoder implements the LARGE pen size, then word wrapping (when enlarging captions) need not be implemented.

(4) Whenever possible, the receiver should render embedded carriage returns as line breaks, since these carriage returns indicate an important aspect of the caption's formatting as determined by the service provider. However, it may sometimes be necessary for the receiver to ignore embedded line breaks. For example, if a caption is to appear in a larger font, and if its window's rows and/or columns are unlocked, the rows of text may need to become longer or shorter to fit within the allocated space. Such automatic reformatting of a caption is known as "word wrap." If decoders support word-wrapping, it must be implemented as follows:

(i) The receiver should follow standard typographic practice when implementing word wrap. Potential breaking points (word-wrapping points) are indicated by the space character (20h) and by the hyphen character (2Dh).

(ii) If a row is to be broken at a space, the receiver should remove the space from the caption display. If a row is to be broken after a hyphen, the hyphen should be retained.

(iii) If an embedded return is to be removed, it should usually be replaced with a space. However, if the character to the left of the embedded return is a hyphen, the embedded return should be removed but NOT replaced with a space.

(iv) This specification does not include optional hyphens, nor does it provide for any form of automatic hyphenation. No non-breaking hyphen is defined. The non-breaking space (A0h in the G1 code set) and the non-breaking transparent space (21h in the G2 code set) should not be considered as potential line breaks.

(v) If a single word exceeds the length of a row, the word should be placed at the start of a new row, broken at the character following the last character that fits on the row, and continued with further breaks if needed.

(g) *Window Text Painting.* (1) All decoders should implement "left", "right", and "center" caption-text justification. Implementation of "full" justification is optional. If "full" justification is not implemented, fully justified captions should be treated as though they are "left" justified.

For "left" justification, decoders should display any portion of a received row of text when it is received. For "ce ter", "right", and "full" justification, decoders may display any portion of a received row of text when it is received, or may delay display of a received row of text until reception of a row completion indicator. A row completion indicator is defined as receipt of a CR, ETX or any other command, except SetPenColor, SetPenAttributes, or SetPenLocation where the pen relocation is within the same row.

Receipt of a character for a displayed row which already contains text with "center", "right" or "full" justification will cause the row to be cleared prior to the display of the newly received character and any subsequent characters. Receipt of a justification command which changes the last received justification for a given window will cause the window to be cleared.

(2) At a minimum, decoders must support LEFT_TO_RIGHT printing.

(3) At a minimum, decoders must support BOTTOM_TO_TOP scrolling. For windows sharing the same horizontal scan lines on the display, scrolling may be disabled.

(4) At a minimum, decoders must support the same recommended practices for scroll rate as is provided for NTSC closed-captioning.

(5) At a minimum, decoders must support the same recommended practices for smooth scrolling as is provided for NTSC closed-captioning.

(6) At a minimum, decoders must implement the "snap" window display effect. If the window "fade" and "wipe" effects are not implemented, then the decoder will "snap" all windows when they are to be displayed, and the "effect speed" parameter is ignored.

(h) *Window Colors and Borders.* At a minimum, decoders must implement borderless windows with solid, black backgrounds (i.e., border type = NONE, fill color = (0,0,0), fill opacity = SOLID), and borderless transparent windows (i.e., border type = NONE, fill opacity = TRANSPARENT)..

(i) *Predefined Window and Pen Styles.* Predefined Window Style and Pen Style ID's may be provided in

the DefineWindow command. At a minimum, decoders should implement Predefined Window Attribute Style 1 and Predefined Pen Attribute Style 1, as shown in Table 4 and Table 5, respectively.

| Style ID # | Justify | Print Direction | Scroll Direction | Word Wrap | Display Effect | Effect Direction | Effect Speed | Fill Color | Fill Opacity | Border Type | Border Color | Usage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | LEFT | LEFT-TO-RIGHT | BOTTOM-TO-TOP | NO | SNAP | n/a | n/a | (0,0,0) Black | SOLID | NONE | n/a | *NTSC Style PopUp Captions* |
| 2 | LEFT | LEFT-TO-RIGHT | BOTTOM-TO-TOP | NO | SNAP | n/a | n/a | n/a | TRANS-PARENT | NONE | n/a | *PopUp Captions w/o Black Background* |
| 3 | CNTR | LEFT-TO-RIGHT | BOTTOM-TO-TOP | NO | SNAP | n/a | n/a | (0,0,0) Black | SOLID | NONE | n/a | *NTSC Style Centered PopUp Captions* |
| 4 | LEFT | LEFT-TO-RIGHT | BOTTOM-TO-TOP | YES | SNAP | n/a | n/a | (0,0,0) Black | SOLID | NONE | n/a | *NTSC Style RollUp Captions* |
| 5 | LEFT | LEFT-TO-RIGHT | BOTTOM-TO-TOP | YES | SNAP | n/a | n/a | n/a | TRANS-PARENT | NONE | n/a | *RollUp Captions w/o Black Background* |
| 6 | CNTR | LEFT-TO-RIGHT | BOTTOM-TO-TOP | YES | SNAP | n/a | n/a | (0,0,0) Black | SOLID | NONE | n/a | *NTSC Style Centered RollUp Captions* |
| 7 | LEFT | TOP-TO-BOTTOM | RIGHT-TO-LEFT | NO | SNAP | n/a | n/a | (0,0,0) Black | SOLID | NONE | n/a | *Ticker Tape* |

**Table 4 Predefined Window Style ID's**

| Predefined Style ID | Pen Size | Font Style | Offset | Italics | Underline | Edge Type | Foregrnd Color | Foregrnd Opacity | Backgrnd Color | Backgrnd Opacity | Edge Color | Usage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | STNDR | 0 | NORMAL | NO | NO | NONE | (2,2,2) White | SOLID | (0,0,0) Black | SOLID | n/a | *Default NTSC Style** |
| 2 | STNDR | 1 | NORMAL | NO | NO | NONE | (2,2,2) White | SOLID | (0,0,0) Black | SOLID | n/a | *NTSC Style* Mono w/ Serif* |
| 3 | STNDR | 2 | NORMAL | NO | NO | NONE | (2,2,2) White | SOLID | (0,0,0) Black | SOLID | n/a | *NTSC Style* Prop w/ Serif* |
| 4 | STNDR | 3 | NORMAL | NO | NO | NONE | (2,2,2) White | SOLID | (0,0,0) Black | SOLID | n/a | *NTSC Style* Mono w/o Serif* |
| 5 | STNDR | 4 | NORMAL | NO | NO | NONE | (2,2,2) White | SOLID | (0,0,0) Black | SOLID | n/a | *NTSC Style* Prop w/o Serif* |
| 6 | STNDR | 3 | NORMAL | NO | NO | UNIFRM | (2,2,2) White | SOLID | n/a | TRANS-PARENT | (0,0,0) Black | *Mono w/o Serif, Bordered Text, No BG* |
| 7 | STNDR | 4 | NORMAL | NO | NO | UNIFRM | (2,2,2) White | SOLID | n/a | TRANS-PARENT | (0,0,0) Black | *Prop. w/o Serif, Bordered Text, No BG* |

**Table 5 Predefined Pen Style ID's** *** "NTSC Style" - White Text on Black Background**

(j) *Pen Size.* Decoders must support the standard, large, and small pen sizes and must allow the caption provider to choose a pen size and allow the viewer to choose an alternative size.

The STANDARD pen size should be implemented such that the height of the tallest character in any implemented font is no taller than 1/15 of the height of the safe-title area, and the width of the widest character is no wider than 1/32 of the width of the safe-title area for 4:3 displays and 1/42 of the safe-title area width for 16:9 displays.

The LARGE pen size should be implemented such that the width of the widest character in any implemented font is no wider than 1/32 of the safe-title area for 16:9 displays. This recommendation allows for captions to grow to a LARGE pen size without having to reformat the caption since no caption will have more than 32 characters per row.

(k) *Font Styles.* Decoders must support the eight fonts listed below. Caption providers may specify 1 of these 8 font styles to be used to write caption text. The styles specified in the "font style" parameter of the **SetPenAttributes** command are numbered from 0 through 7.

The following is a list of the 8 required font styles. For information purposes only, each font style references one or more popular fonts which embody the characteristics of the style:

0 - Default (undefined)
1 - Monospaced with serifs (similar to Courier)
2 - Proportionally spaced with serifs (similar to Times New Roman)
3 - Monospaced without serifs (similar to Helvetica Monospaced)
4 - Proportionally spaced without serifs (similar to Arial and Swiss)
5 - Casual font type (similar to Dom and Impress)
6 - Cursive font type (similar to Coronet and Marigold)
7 - Small capitals (similar to Engravers Gothic)

Font styles may be implemented in any typeface which the decoder manufacturer deems to be a readable rendition of the font style, and need not be in the exact typefaces given in the example above. Decoders must include the ability for consumers to choose among the eight fonts. The decoder must display the font chosen by the caption provider unless the viewer chooses a different font.

(l) *Character Offsetting.* Decoders need not implement the character offsetting (i.e., subscript and superscript) pen attributes.

(m) *Pen Styles.* At a minimum, decoders must implement normal, italic, and underline pen styles.

(n) *Foreground Color and Opacity.* (1) At a minimum, decoders must implement transparent, translucent, solid and flashing character foreground type attributes.

(2) At a minimum, decoders must implement the following character foreground colors: white, black, red, green, blue, yellow, magenta and cyan.

(3) Caption providers may specify the color/opacity. Decoders must include the ability for consumers to choose among the color/opacity options. The decoder must display the color/opacity chosen by the caption provider unless the viewer chooses otherwise.

(o) *Background Color and Opacity*. (1) Decoders must implement the following background colors: white, black, red, green, blue, yellow, magenta and cyan. It is recommended that this background is extended beyond the character foreground to a degree that the foreground is separated from the underlying video by a sufficient number of background pixels to insure the foreground is separated from the background.

(2) Decoders must implement transparent, translucent, solid and flashing background type attributes. Caption providers may specify the color/opacity. Decoders must include the ability for consumers to choose among the color/opacity options. The decoder must display the color/opacity chosen by the caption provider unless the viewer chooses otherwise.

(p) *Character Edges*. Decoders must implement separate edge color and type attribute control.

(q) *Color Representation*. (1) At a minimum, decoders must support the 8 colors listed in Table 6.

| Color | Red | Green | Blue |
|---|---|---|---|
| Black | 0 | 0 | 0 |
| White | 2 | 2 | 2 |
| Red | 2 | 0 | 0 |
| Green | 0 | 2 | 0 |
| Blue | 0 | 0 | 2 |
| Yellow | 2 | 2 | 0 |
| Magenta | 2 | 0 | 2 |
| Cyan | 0 | 2 | 2 |

**Table 6 Minimum Color List Table**

(2) When a decoder supporting this Minimum Color List receives an RGB value not in the list, it will map the received value to one of the values in the list via the following algorithm:

- All one (1) values are to be changed to 0
- All two (2) values are to remain unchanged
- All three (3) values are to be changed to 2

For example, the RGB value (1,2,3) will be mapped to (0,2,2), (3,3,3) will be mapped to (2,2,2) and (1,1,1) will be mapped to (0,0,0).

(3) Table 7 is an alternative minimum color list table supporting 22 colors.

| Color | Red | Green | Blue |
|---|---|---|---|
| Black | 0 | 0 | 0 |
| Gray | 1 | 1 | 1 |
| White | 2 | 2 | 2 |
| Bright White | 3 | 3 | 3 |
| Dark Red | 1 | 0 | 0 |
| Red | 2 | 0 | 0 |
| Bright Red | 3 | 0 | 0 |
| Dark Green | 0 | 1 | 0 |
| Green | 0 | 2 | 0 |
| Bright Green | 0 | 3 | 0 |
| Dark Blue | 0 | 0 | 1 |
| Blue | 0 | 0 | 2 |
| Bright Blue | 0 | 0 | 3 |
| Dark Yellow | 1 | 1 | 0 |
| Yellow | 2 | 2 | 0 |
| Bright Yellow | 3 | 3 | 0 |
| Dark Magenta | 1 | 0 | 1 |
| Magenta | 2 | 0 | 2 |
| Bright Magenta | 3 | 0 | 3 |
| Dark Cyan | 0 | 1 | 1 |
| Cyan | 0 | 2 | 2 |
| Bright Cyan | 0 | 3 | 3 |

**Table 7 Alternative Minimum Color List Table**

When a decoder supporting the Alternative Minimum Color List in Table 7 receives an RGB value not in the list (i.e., an RGB value whose non-zero elements are not the same value), it will map the received value to one of the values in the list via the following algorithm:

- For RGB values with all elements non-zero and different - e.g., (1,2,3), (3,2,1), and (2,1,3), the 1 value will be changed to 0, the 2 value will remain unchanged, and the 3 value will be changed to 2.
- For RGB values with all elements non-zero and with two common elements - e.g. (3,1,3), (2,1,2), and (2,2,3), if the common elements are 3 and the uncommon one is 1, then the 1 elements is changed to 0; e.g. (3,1,3) -> (3,0,3). If the common elements are 1 and the uncommon element is 3, then the 1 elements are changed to 0, and the 3 element is changed to 2; e.g. (1,3,1) -> (0,2,0). In all other cases, the uncommon element is changed to the common value; e.g., (2,2,3) -> (2,2,2), (1,2,1) -> (1,1,1), and (3,2,3) -> (3,3,3).

All decoders not supporting either one of the two color lists described above, must support the full 64 possible RGB color value combinations.

(r) *Character Rendition Considerations.* In NTSC Closed Captioning, decoders were required to insert

leading and trailing spaces on each caption row. There were two reasons for this requirement:

(i) to provide a buffer so that the first and last characters of a caption row do not fall outside the safe title area, and

(ii) to provide a black border on each side of a character so that the "white" leading pixels of the first character on a row and the trailing "white" pixels of the last character on a row do not bleed into the underlying video.

Since caption windows are required to reside in the safe title area of the DTV screen, reason i (above) is not applicable to DTVCC captions.

The attributes available in the **SetPenAttributes** command for character rendition (e.g.,character background and edge attributes) provide unlimited flexibilty to the caption provider when describing caption text in an ideal decoder implementation. However, manufacturers need not implement all pen attributes. Thus it is recommended that no matter what the level of implementation, decoder manufacturers should take into account the readability of all caption text against a variety of all video backgrounds, and should implement some automatic character delineation when the individual control of character foreground, background and edge is not supported.

(s) *Service Synchronization.* Service Input Buffers must be at least 128 bytes in size. Caption providers must keep this lower limit in mind when following Delay commands with other commands and window text. In other words, no more than 128 bytes of DTVCC commands and text should be transmitted (encoded) before a pending Delay command's delay interval expires.

(t) *Settings.* Decoders must include an option that permits a viewer to choose a setting that will display captions as intended by the caption provider (a default). Decoders must also include an option that allows a viewer's chosen settings to remain until the viewer chooses to alter these settings, including periods when the television is turned off.

PART 79—CLOSED CAPTIONING OF VIDEO PROGRAMMING

Part 79 of Title 47 of the Code of Federal Regulations is amended as follows:

1. The authority citation for Part 79 continues to read as follows:

Authority: 47 U.S.C. 613

2. Section 79.1(a)(4) is amended to read as follows:

(4) Closed captioning. The visual display of the audio portion of video programming pursuant to the technical specifications set forth in Part 15 of this chapter

3. Section 79.1(c) is amended to read as follows:

(c) Obligation to Pass Through Captions of Already Captioned Programs. All video programming distributors shall deliver all programming received from the video programming owner or other

origination source containing closed captioning to receiving television households with the original closed captioning data intact in a format that can be recovered and displayed by decoders meeting the standards of Part 15 of this chapter unless such programming is recaptioned or the captions are reformatted by the programming distributor.

# Appendix C

## FINAL REGUALTORY FLEXIBILITY ANALYSIS

As required by the Regulatory Flexibility Act ("RFA"),[121] an Initial Regulatory Flexibility Analysis ("IRFA") was incorporated into the *Notice of Proposed Rule Making* ("NPRM") in this docket, ET Docket 99-254.[122] The Commission sought written public comment on the proposals in the NPRM, including comment on the IRFA. The Final Regulatory Flexibility Analysis ("FRFA") in this Report and Order conforms to the RFA.[123]

### A. Need for, and Objectives of, the Report and Order.

This Report and Order amends the Commission's rules to adopt technical standards for the display of closed captions on digital television ("DTV") receivers. In 1990, Congress passed the Television Decoder Circuitry Act ("TDCA").[124] The TDCA requires that any apparatus designed to receive television broadcast signals, manufactured or imported for use in the United States, must be able to display closed captioned information if its television screen is 33 centimeters (13 inches) or larger. The TDCA also instructs the Commission to ensure that closed captioning service continues to be available to consumers as new video technology is developed. The introduction of digital broadcasting requires the Commission to update its rules to fulfill its continuing obligations under the TDCA.

### B. Summary of Significant Issues raised by Public Comments in Response to the IRFA.

No comments were filed in response to the IRFA or specifically regarding small entities.

### C. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply.

The RFA directs agencies to provide a description of, and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.[125] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdictions." In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act, 15 U.S.C. § 632, unless the

---

[121] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et. seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

[122] *See* ET Docket 99-254, FCC 99-180, 64 FR 41897 (1999).

[123] *See* 5 U.S.C. § 604.

[124] Pub. L. No. 101-431, 104 Stat. 960 (1990) (codified at 47 U.S.C. §§ 303(u), 303(b)).

[125] 5 U.S.C. § 603(b)(3).

Commission has developed one or more definitions that are appropriate to its activities.[126] A "small business concern" is one that: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) meets any additional criteria established by the Small Business Administration ("SBA").[127]

Television Equipment Manufacturers. According to the SBA's regulations, television equipment manufacturers must have 750 or fewer employees in order to qualify as a small business concern.[128] Census Bureau data indicates that there are 858 U.S. companies that manufacture radio and television broadcasting and communications equipment, and that 778 of these firms have fewer than 750 employees and would be classified as small entities.[129] The Census Bureau category is very broad, and specific figures are not available as to how many of these firms are manufacturers of television equipment. However, we believe that many of the companies that manufacture television equipment may qualify as small entities.

Multichannel Video Programming Distributors ("MVPDs"). The SBA has developed a definition of small entities for cable and other pay television services under Standard Industrial Classification 4841 (SIC 4841), which covers subscription television services, which includes all such companies with annual gross revenues of $11 million or less.[130] This definition includes cable systems operators, closed circuit television services, direct broadcast satellite services, multipoint distribution systems, satellite master antenna systems and subscription television services. According to the Census Bureau, there were 1,423 such cable and other pay television services generating less than $11 million in revenue that were in operation for at least one year at the end of 1992.[131] The following provides a more precise estimate for the affected MVPD services individually.

Cable Services or Systems. The Commission has developed, with SBA's approval, its own definition of a "small cable company" and "small system" for the purposes of rate regulation. Under the Commission's rules, a "small cable company," is one serving fewer than 400,000 subscribers nationwide.[132] Based on our most recent information, we estimate that there were 1,439 cable companies

---

[126] *See* 5 U.S.C. § 601(3).

[127] 15 U.S.C. § 632.

[128] 13 C.F.R. § 121.201, (SIC) Code 3663.

[129] U.S. Department of Commerce, 1992 Census Transportation, Communications, and Utilities, SIC Code 3663 (issued may 1995).

[130] 13 C.F.R. §121.201.

[131] 1992 Census, *supra*, at Firm Size 1-123. *See Implementation of Sections of the Cable Telecommunications Consumer Protection and Competition Act of 1992, Rate Regulation and Cable Pricing Flexibility*, MM Docket No. 92-266 and CS Docket No. 96-157, Memorandum Opinion and Order and Notice of Proposed Rule Making, 11 FCC Rcd 9517, 9531 (1996).

[132] 47 C.F.R. § 76.901(e). The Commission developed this definition based on its determinations that a small cable company is one with annual revenues of $100 million or less. *Implementation of Sections of the 1992 Cable Act: Rate Regulation*, MM Docket Nos. 92-266 & 93-215, Sixth Report and Order and Eleventh Order on Reconsideration, 10 FCC Rcd 7393 (1995).

that qualified as small cable companies at the end of 1995.[133] Since then, some of those companies may have grown to serve over 400,000 subscribers, and others may have been involved in transactions that caused them to be combined with other cable companies. Consequently, we estimate that there are fewer than 1,439 small entity cable companies. The Commission's rules also define a "small system," for the purposes of cable rate regulation, as a cable system with 15,000 or fewer subscribers.[134] We do not request nor do we collect information concerning cable systems serving 15,000 or fewer subscribers and thus are unable to estimate at this time the number of small cable systems nationwide.

The Communications Act also contains a definition of a "small cable operator," which is "a cable operator that, directly or through an affiliate, serves in the aggregate fewer than 1 percent of all subscribers in the United States and is not affiliated with any entity or entities whose gross annual revenues in the aggregate exceed $250,000,000."[135] The Commission has determined that there are 61,700,000 subscribers in the United States. Therefore, we found that an operator serving fewer than 617,000 subscribers is deemed a small operator, if its annual revenues, when combined with the total annual revenues of all of its affiliates, do not exceed $250 million in the aggregate.[136] Based on available data, we find that the number of cable operators serving 617,000 subscribers or less totals 1,450.[137] Although it seems certain that some of these cable system operators are affiliated with entities whose gross annual revenues exceed $250,000,000, we are unable at this time to estimate with greater precision the number of cable system operators that would qualify as small cable operators under the definition in the Communications Act. Furthermore, of those cable system operators that may qualify as small cable operators, only those that deliver digital cable programming would be affected by our rules. According to General Instrument Corporation, approximately 1,000 headends are currently delivering digital video signals.[138] It is uncertain how many of these 1,000 cable operators fall under the definition of a small cable company based on the Commission's rules or the Communications Act, but in any event the number would be no greater than 1,000.

Direct Broadcast Satellite ("DBS") Service. The SBA includes DBS service in its classification of cable and other pay television services. Therefore, a small DBS service is defined as a company generating $11 million or less in annual receipts.[139] As of November 1999, there were four DBS licensees, one of which was not in operation. Providing DBS service requires a great investment of capital to build, launch, and operate satellite systems. Typically, small businesses do not have the financial ability to become DBS licensees because of the high implementation costs associated with launching satellites. Most recent industry statistics suggest that the revenue attributed to DBS

[133] Paul Kagan Associates, Inc., *Cable TV Investor*, Feb. 29, 1996 (based on figures for Dec. 30, 1995).

[134] 47 C.F.R. § 76.901(c).

[135] 47 U.S.C. § 543(m)(2).

[136] 47 C.F.R. § 76.1403(b).

[137] Paul Kagan Associates, Inc., *Cable TV Investor*, Feb. 29, 1996 (based on figures for Dec. 30, 1995).

[138] General Instrument Corporation Comments at 6.

[139] 13 C.F.R. § 121.201.

subscribers for EchoStar was $682.8 million for the year of 1998 and $1.55 billion for DirecTV. We do not have similar revenue information for the third operating licensee, Dominion Video Satellite, Inc. However, we do not believe that any DBS licensees could be categorized as a small business.

Home Satellite Dish ("HSD") Service. The market for HSD service is difficult to quantify. HSD owners have access to more than 500 channels of programming placed on C-band satellites by programmers for receipt and distribution by MVPDs, of which 350 channels are scrambled and approximately 150 channels are unscrambled.[140] To receive scrambled channels, an HSD owner must purchase an integrated receiver-decoder from an equipment dealer and pay a subscription fee to an HSD programming packager. Thus, those HSD users that subscribe to a programming package are similar to consumers that subscribe to cable and other pay television services. Accordingly, it appears that the definition of small entity under SIC 4841 (i.e., all such companies generating $11 million or less in annual receipts[141]) would be applicable to this service.

According to the most recently available information, there are approximately 20 to 25 program packagers nationwide offering packages of scrambled programming to retail consumers.[142] As of June 1999, these program packagers provide subscriptions to approximately 1,783,411 subscribers nationwide.[143] This is an average of about 90,000 subscribers per program packager. This is substantially smaller than the 400,000 subscribers used in the Commission's definition of a small multiple system operator ("MSO"). Furthermore, because this is an average, it is likely that some program packagers may be substantially smaller. Therefore, this Report and Order could affect all 25 program packagers.

**D. Description of Projected Reporting, Record Keeping and Other Compliance Requirements.**

The Commission's rules require television receivers to be verified for compliance with applicable FCC technical requirements. See 47 CFR Sections 15.101, 15.117, and 2.951, *et seq.* Documentation concerning the verification must be kept by the manufacturer or importer. The rules adopted in this proceeding require that digital television receivers comply with industry-developed standards for closed captioning display. However, testing regarding closed captioning display is not necessary because compliance with the industry-developed standards, and the associated Commission rules, can be determined easily during the equipment design process. The Commission may, of course, ask manufacturers and importers to document upon occasion how a particular television receiver or computer system complies with the closed captioning display requirements. This should be a nominal request, requiring no specific expertise or knowledge, and should be accomplished in a very brief amount of time.

---

[140] *See Annual Assessment of the Stations of Competition in Markets for the Delivery of Video Programming*, CS Docket No. 97-141, Fourth Annual Report, 13 FCC Rcd 1034, 1077-8 (1998) ¶ 68.

[141] 13 C.F.R. § 121.201.

[142] *Id.* at 1077-8 ¶ 68.

[143] *See Annual Assessment of the Stations of Competition in Markets for the Delivery of Video Programming*, CS Docket No. 99-230, Sixth Annual Report, 14 FCC Rcd 978, 1019 (2000) ¶ 84.

**E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered.**

The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities. 5 U.S.C. § 603(c).

Some commenters representing cable operators and cable equipment manufacturers are concerned that adoption of the proposals in the NPRM will render many cable boxes obsolete.[144] They state that the boxes that are used to receive digital cable programming are unable to process EIA-708 data. These boxes only read closed captioning data which has been delivered through a cable system pursuant to the Society of Cable Telecommunications Engineers ("SCTE") standard DVS-157.[145] Many cable boxes that only receive caption data delivered via DVS-157 are already in customer's homes and are being used to view digital cable programming on analog televisions.

Cable commenters propose that the Commission adopt rules that would require that digital closed captioning information be delivered in the DVS-157 format and would require that digital televisions ("DTVs") contain decoder circuitry that responds to DVS-157. Alternatively, they state that the Commission could consider a "dual carriage" requirement wherein broadcasters would deliver captions in both the EIA-708 format and the DVS-157 format.[146] The third option they suggest is that the Commission detail which advanced features are required, such as support for multiple character colors, and let manufacturers design receivers to accomplish these features using existing captioning standards and the digital television's built-in graphic processing capabilities.[147]

We disagree with these suggested alternatives to the proposed rules. We note that the comments and replies in this proceeding express an overwhelming support for adoption of the EIA-708 standard.[148] Although commenters have raised some concerns regarding the amount of EIA-708 to include in our rules, most were in favor of adopting at least portions of the standard. Adoption of EIA-708 will supply manufacturers with a uniform set of rules to follow in providing closed captioning capability. Furthermore, EIA-708 is the logical choice for delivering closed caption information to digital television receivers because DTVs have been designed to receive programming formatted pursuant to the digital

[144] *See* GI Comments, NCTA Comments, and AT&T Comments.

[145] General Instruments developed DVS-157 in 1992-1993 as a means for delivering NTSC captioning data (formatted pursuant to industry standard EIA-608) within digital video signals.

[146] GI Comments at 7-8; ATT Reply Comments at 3-6.

[147] GI Comments at 8-12.

[148] *Supra* at paragraphs 18-31.

television transmission standard, ATSC A/53. The transmission standard reserves a data stream for the delivery of caption information. EIA-708 was developed to fill that reserved space. In the NPRM the Commission proposed that manufacturers comply with the regulations within one year. However, to minimize the impact on businesses, including small entities, we have provided two years in order to comply.

We note that SCTE, which is currently drafting its Digital Cable Network Interface Standard, has delayed modifying the closed captioning requirements in that standard, pending FCC action in this proceeding. SCTE notes that, "Some have proposed that the references to the current practice of using DVS-157 to transport captions be removed. They want to be able to build portable receiving devices compatible with these specifications without the support to decode captions carried in the DVS-157 format."[149] Therefore, it appears that the industry is already working to resolve this standards issue.

**F. Report to Congress.**

The Commission will send a copy of the Report and Order, including this FRFA, in a report to be sent to Congress pursuant to SBREFA.[150] In addition, the Commission will send a copy of the Report and Order, including FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the Report and Order and FRFA (or summaries thereof) will also be published in the Federal Register.[151]

[149] SCTE DVS/335, "Report of DVS/313 Drafting Group on Outstanding Issues of DVS 313 Revision 1", April 27, 2000.

[150] *See* 5 U.S.C.§ 801(a)(1)(A).

[151] *See* 5 U.S.C. § 604(b).

**Statement of Commissioner Harold W. Furchtgott-Roth,**
**Concurring in Part and Dissenting in Part**

I concur in all of today's Order but Part B, which adopts "additional enhancements" that go beyond the minimum decoder requirements of Section 9 of the industry's EIA-708 standard. I would simply have implemented the Section 9 plan, a course of action that would have been more consistent with our statutory directive in this proceeding.

In the Television Decoder Circuitry Act, Congress required the Commission to adopt rules governing television circuitry designed to display closed captioning. We adopted such rules in 1991. *See* 47 C.F.R. section15.119. Congress further instructed, however, that "[a]s new video technology is developed, the Commission shall take such action as it deems appropriate to ensure that closed captioning services *continues to be available* to consumers." 47 U.S.C. section 330(b) (emphasis added).

I believe that, in essence, this provision instructs us to carry over our current analog closed captioning rules into the digital television age. That is, section 330(b) tells us to guarantee that the closed captioning provided today under section 15.119 is not somehow omitted or diminished – *i.e.*, that it "continues to be available" -- as the industry moves toward new digital technology. To "continue" means to maintain the *status quo*; it does not mean to create a new, more expansive regulatory regime. Thus, section 330(b) does not create authority to add further requirements regarding features and functionalities not now required, as the do the "enhancements" adopted today.

To all of this, the Commission responds by citing Part 1 of the TDCA. *See Report & Order* at para. 17. That section, however, is simply a legislative finding. It is not, of course, a binding statutory directive. However one might construe it, then, it cannot trump the plain meaning of section 330(b).

For these reasons, I must respectfully dissent from the decoder requirements that go over and above those of Section 9.

# # #